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The Formulation and Standardization of a Series of Graded Speech Tests

BY

Hawk

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PART I

THE PROBLEM

The development of a series of graded speech tests, to serve as a measuring scale for speech attainment, is the outgrowth of the tabulation of some 600 cases by the writer during a period of approximately five years. The types of cases have differed from slight inaccuracies of speech, such as is found in letter substitution and oral inactivity, to stuttering, psychic disturbances affecting the speech function, and organic conditions which interfere with the normal functioning of the central, or peripheral parts of the speech mechanism.

The study has included children of pre-school age, grade-school children, pupils in high school and university, and adults beyond school age, who have been referred for speech training. The investigations include cases studied by the writer as a teacher of corrective speech in the public schools of Pittsburgh, Pennsylvania; in the Iowa Child Welfare Research Station; State University of Iowa; the Speech Clinic in the Department of Speech at the University of Wisconsin; and eight grades in the Madison Public Schools, Madison, Wisconsin.

The temporary norms and results discussed in this monograph are the result of two detailed studies—one in the Madison Public Schools, and the other in the University. The study of the public school group constitutes a cross-section survey of speech in the Madison Schools, and consists of an unselected group, ranging from first through the eighth grade, in eight different schools. One complete grade from each school was chosen, and all the children in that grade were tested by the writer, uniform material being employed in each grade, and a uniform method of procedure followed throughout the series of tests. The time allotment was not less than fifteen minutes, nor more than an hour in an individual examination, the total number of children examined in the survey of grade schools being 276. The total number of University students included was 151, making a total of 427 studies.

The norms for university students and adults were obtained from two groups of University students. First, a control group consisting of forty students in Freshman English classes, a few of these being upper classmen, but none of whom represent speech majors nor minors, nor students referred at any time to the Department of Speech because of speech difficulty, nor because of special interest in the field of speech. These are therefore an unselected group.

The second group represents 111 students who have been enrolled in the Department of Speech as speech majors or minors, or because of speech disturbances, and who have been given the tests for university students or adults as an aid in diagnosing their speech difficulties, and as a basis for treatment or speech training.

The tests have been given to a sufficient number of subjects to obtain temporary norms and correlation indexes, and in order properly to weight the more significant of the tests, in forming a team of tests which may be used when it is desirable to obtain a rapid, and reasonably accurate estimate of the speech reaction in the minimum length of time. The tests have been found serviceable in diagnosing letter substitution; oral inactivities of a mild or severe type, showing the part of the speech mechanism which seems to be involved, as in an inactivity of the soft palate, in nasal obstruction, in tongue-tie, lingual, labial and dental conditions which produce ineffective speech; in degrees of deafness accompanied by indistinct speech, wherein certain consonants are frequently inaccurate and substitutions may occur; in foreign accent, in which such substitutions are offered as th for s, v for w, ee (phonetic symbol i:) for vowel ĭ: in stuttering showing the sound on which blocking occurs most frequently; vocal difficulties such as hoarseness, harshness, tonal monotony, poor quality of tones; in respiratory difficulties resulting in speech which is almost inaudible, or in "breathy" tones indicative of poor breath control in phonation; in psychic disturbances affecting the speech function, as in hysteria, traumatic neuroses, excessively rapid speech, jerky, broken rhythm, very slow rate of utterance, feelings of inferiority and embarrassment; in cases where an organic condition has interfered with good speech, as in post-operative cleft palate cases and paralysis.

In cases which have been diagnosed by a physician the tests are useful in outlining course of treatment in speech hygiene, and in corrective exercises. Many cases of malocclusion, due to protrusion of upper or lower jaw, appear in the cases tested, and in an additional 1100 university freshmen (Sept. 1920) to have less relation to poor speech than has been previously supposed. A very small percentage of those tested in this group manifested anterior or lateral "lisp," or indistinct speech, despite dental conditions which often seemed to favor the development of such tendencies. In the majority of cases where "lisping," or substitution of *th* for *s*, or poorly enunciated *s* and *z* sounds occurred, it was found to be due to oral inactivity and inaccurate tongue position. The more intelligent student apparently compensates for the dental condition by making a special effort to overcome the handicap, and with good success so far as clear speech is concerned. We believe that in a group from a less favored environment, inaccuracies due to malocclusion, and as a by-product of the dental condition, are much more numerous. We have found it to be so among the comparatively small number of people tested outside the school and university group.

From the standpoint of phonetics, the manner in which the words are stressed aids in diagnosing the speech difficulty. In the tests the sound which the experimenter is checking occurs in strong position, at the beginning, middle, or end of a word, and should be reasonably distinct in utterance. When final syllables are dropped, less important words or syllables omitted, it may be an indication of undue nervous tension, resulting in rapid, jerky, or broken rhythm; excessively rapid utterance as in the speaker whose motor speech mechanism cannot keep pace with his rapid thinking; or it may indicate timidity and fear. An over-compensative type of individual tends to over-stress the sounds, or to give strong values to sounds which occur in weak position, where there should be no stress.

From these several angles we have found the tests of value in diagnosing conditions which interfere with the production of clear-cut, distinct utterance.

It is obvious that for the success of additional surveys and for the obtaining of definite norms, investigators should have access to the material used in previous surveys, and that a uniform plan of procedure should be employed. The writer has encountered much difficulty in obtaining information regarding previous surveys and the methods of conducting them. Results have been published in various surveys, but very little has been published regarding the exact methods used, and there seems to have been little effort to check up results by a uniform method of approach to the problem.

A speech survey was made in St. Louis Public Schools by Dr. J. E. Wallin (35), 1915-16, by the questionnaire method. He found in his survey of 89,057 chlidren, that 2.8% were speech defect cases, 1.6% were lispers, .7% stutterers, and .4% miscellaneous. The incidence of male to female was 3 to 1.

Conradi (11) in 1904 made a speech survey for speech defects in the schools of Kansas City, Milwaukee, Cleveland, Louisville, Albany, and Springfield (Mass.) examining in all some 87,440 children. He found that 2.46% were speech defect cases.

Miss Pauline Camp*, in charge of classes for the deaf in schools of Grand Rapids, Michigan, found that 13% were speech cases among 9,000 normal children examined.

Dr. Smiley Blanton (5), in a survey of Madison School children, including 8,000 cases in 17 schools, found 5.6% to be speech cases.

Methods of examination and tabulation have varied from that based on the individual surveys mentioned above, and the questionnaire method to cases referred to the speech teachers by classroom teacher. The studies have not always been based on examinations made by teachers specially trained in the field of speech correction. There seems to be no generally accepted method for making a speech survey, and standards vary widely. It is not surprising therefore that percentages and results obtained should differ widely when surveys are compared.

Speech measurements, to be serviceable, should be adapted to different periods of growth, in rather a broad way. We cannot group such tests by years while they are still in the early experimental stage. They may, however, be classed as educational measurements, and grouped by grades in order that they may become serviceable, may be definitely standardized, improved and extended in use. Speech, like physical growth, is a process, which advances through periods of development, acceleration and arrest. The manner in which the child passes through various stages in acquiring and perfecting a technique of speech follows the natural rhythmic processes with which we are familiar in studying laws of physical growth (1).

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*Report of the Board of Education, Grand Rapids, Michigan, 1920.

There are periods of "arrest" or "retardation" in speech, which stand apart from the natural order of growth, and which may be pathological in nature; of psychic origin; or due to some incoordination of the various parts of the speech mechanism. It should therefore be an object of our inquiry to ascertain what should constitute the *minimum requirement* in speech at a given period.

For children of pre-school age and for first, second, and third grades; for foreigners having no reading knowledge of English; for illiterates; for kindergarten children, word lists and sentences present too many difficulties. For these a picture test has been developed as described in this monograph. Word lists spoken first by the teacher and repeated by the child (which is the method followed in many surveys), is inadequate, as the child tends to reproduce imitatively the sound which he hears even though habitually he may substitute totally different sounds when using the word in spontaneous speech. It is well known that in studies of speech among the feeble-minded the child often repeats the last word which he hears in automatic parrot-like fashion, and yet he may be incapable of initiating the words in spontaneous speech without having received a previous auditory stimulus (34).

Words and sentences containing the consonants in initial position only, and vowel sentences such as have been arranged from physiological alphabets, are inadequate unless they test the consonants in all positions, initial, middle, and final, and with relation to its position as being weak or strong in form.

In writing of the Webster Key to Pronunciation, Margaret De Witt writes: "There is no 'key' good or bad that can help a person who uses non-standard dialect to attain a standard pronunciation unless the person has a clear idea what sound each symbol of the key represents."

Sweet and the earlier phoneticians in presenting phonetic symbols for the language were working with a view to aiding the foreigner who wished to acquire the language. We would carry the utilization of the symbols of the International Phonetic Association much further than that, in making the child familiar with the difference between strong and weak forms, early in his school course, and while language is still more or less in the moulding process. The majority of people who have use for the phonetic alphabet are English speaking people. The foreigner should have access to the phonetic key and be trained in its use, but the primary object in formulating such standards as the International Phonetic Association has evolved should be in order to familiarize people already familiar with the language, how to become free from localisms, provincial, and marked dialect differences. It should be noted that the phonetic, and not the written alphabet, has been followed here, thus avoiding duplication and including sounds not given in the written alphabet.

A series of standardized and properly graded tests is therefore needed in order that uniform methods of procedure may be secured as to the development of speech from infancy to the third year, and thence on to the attainment of adult speech. A careful record of error types, classification of disabilities, diagnosis as to the part of the speech mechanism involved, and diagnosis of the fundamental speech difficulty is needed for prognosis and treatment. Progressive elimination of errors through corrective measures and training are necessary, with records of same, before we shall be in a position to draw logical conclusions as to time required for the treatment of various types of speech defects, improvement of methods in training, and for general scientific advancement in this field.

Language becomes a part of the child's pattern-reaction almost from birth, although articulate language is a matter of slow growth, experimentation, imitation, trial and error. The formation of language habits involves not merely the larynx and cerebral centers governing the speech function, but the entire organism. According to Watson (36), the integrated activities of the individual which constitute his personality and his particular mode of response, depend upon certain speech patterns which have been worked out during the adjustment of the individual to his social environment, even from infancy.

Anatomically, the formation of habits of speech involves the diaphragm, lungs, intercostal muscles and thorax, musculature of the pharynx, intrinsic and extrinsic muscles of the larynx, the nasal cavity, hard and soft palate, cheeks, tongue, teeth and lips. The chief innervation is from the cranial nerves and branches. The neck and chest muscles are many of them supplied by branches from the upper cervical segments. Thus we have an intricate and complex mechanism involving many muscles, nerves, and blood vessels, bony structures, cartilages and ligaments which from infancy on, the child is some three years in mastering, normally, and to which a slight mechanical interference, and organic abnormality, a psychic disturbance (such as inhibitions caused by fear and traumatic shock, hysteria, feelings of inferiority and embarrassment), physical debility following illnesses, or functional disturbances of innervation and muscle tonus, may cause the temporary or permanent, partial or complete, loss of the speech function.

The normal child begins to distinguish sounds in the early months of life; after a few months he begins to coordinate chance, irregular sounds into imitations of the sounds which he hears; he begins to associate words with objects and ideas, and after this his progress is rapid. There are periods when his speech progress passes through stages of "arrest," when he seems for a time to have forgotten certain sounds which it was supposed he had mastered. Not until he is about three years of age has he usually acquired a degree of control of the speech mechanism sufficient to enable him to cover the range of simple consonant and vowel sounds used in articulate speech (19).

No one test, then, will be sufficient to serve as a measuring scale for speech for all the various periods, nor is any unsupplemented test in articulation infallible. Psychological tests similar in plan to those used for rating intelligence, vocational trends, and special abilities have been developed by various authors for the measurement of language abilities. These include tests in silent (26) and oral reading (15), comprehension and reading ability (26), vocabulary tests (31), understanding of sentences (32), word discrimination (33), sentence completion (37), and the like. These possess an important diagnostic value, but several of them are in nature distinctly tests of intelligence. While it is desirable to use certain of these which seem so closely related to the speech reaction that to disregard them, in formulating a series of speech reaction tests, would be to neglect a valuable aid in diagnosis of speech effectiveness, and in attempting to give a speech rating, it is necessary to supplement them by tests which may serve as a definite measure of speech attainment. One must be able to ascertain deviations from an accepted standard, and to estimate the individual's probable capacity for developing speech which shall conform to a broad generally accepted standard (18).

SUMMARY

I. Investigators have not employed uniform methods of examination and tabulation, and scientific data is lacking.

II. A series of graded speech tests meets the need of standardization of examination methods in speech.

PART II

The Formulation of Testing Material

The study of psychiatry has shown that mental functions are an adaptive mechanism which enable the individual to adjust to his environment (36). The quality of the speech reaction has been recognized as one of the criteria by which we may judge of the adjustability of the individual, or of his ability to cope with various situations. Speech is the medium through which he reveals his personality, under ordinary conditions. Any disorder in the mental life may cause the individual to adapt less successfully. The speech may therefore prove an important index in case study and analysis.

The wide range of possible variations and conditioning factors in the speech reaction is evident from the fact that the mental functions are influenced by physiological and metabolic changes in the organism. We likewise know that there is an intimate relationship between emotional states and glandular activity (8). Analysis has shown that fear, rage and pain excite certain glands causing the liberation or sugar from the liver to such an extent that sugar may appear long after the cessation of the emotion itself. Fear, anger, worry and distress have been shown to be attended by cessation of the contractions of the stomach and intestines. These mental states also reduce or partially abolish secretion of gastric juices. Thus adrenalin lessens muscular fatigue, sends the blood to vitally important organs, and provides against serious hemorrhage.

The expression of the emotions in speech will be the resultant of previous training, amount of habitual inhibition, previously established conditioned reflexes, under conditions of intense emotion, and previous responses of the individual under similar conditions (38). Under conditions which have not previously occurred, the reaction may be in any one of several directions, as full consciousness is only concerned with new and unusual adjustments, which have no possibility of having become semi-automatic or "fixed" by habit-pattern reactions. Ideas arise out of previously existing mental states and the speech reaction is fundamentally based on the life history of the individual, his inherited and acquired characteristics modified by training and environment. While we may not be able to predict the type of speech reaction in any given set of circumstances, we may interpret the reaction after it has ocurred, and may analyze the factors there-in which remains constant, and upon which our diagnosis, prognosis, and treatment may be based.

Prince has dealt extensively with the importance of psychic factors in the individual's adjustment to his environment (23). A study of the complex factors involved in the speech reaction indicates that in the formulation of a team of tests for diagnostic purposes and for prediction as to the likelihood of overcoming a certain type of speech disorder, it will be necessary to ascertain which of a large series of possible tests are most important from the standpoint of speech diagnosis.

Besides tests in Articulation and Spontaneous Speech, which were prepared by the writer, an additional set of tests was desired with the proper weighting to be used in a team of tests for objective measurements. At the outset several tests were used and later discarded, such as tests for type of imagery, auditory and visual memory span, reading ability and comprehension, tests for language ability, association tests, tests in constructive imagination, and learning curves, all of which had been previously standardized by their various authors.

Bluemel (7) has discussed the theory of transient auditory and visual amnesia (although he relinquished his early theory in later life). Swift (30), however, in various writings holds strongly to the transient visual or auditory amnesia theory. It was felt that by testing out a group of university students suffering from various types of speech disorder, and also using an additional group of psychopathic individuals, in whom, if anywhere, the defective imagery might be supposed to be strongly in evidence,—some criterion as to the value of such tests for diagnosis might be obtained. The results of tests of imagery given to 46 university students revealed no marked deviation from the norms set for types of imagery.

80% were shown to possess mixed visual and auditory imagery
52% “ “ “ “ visuo-auditory type
28% “ “ “ “ audito-visual type
13% “ audito-moteur or visuo-moteur
55% “ audito-tactual or visuo-tactual
2% “ audito-emoto or visuo-emoto type

Comparing this with Starch's norms, we find:

51% in whom visual imagery predominates
23.3% in whom auditory imagery predominates
14.4% with motor imagery
9.5% with tactual images
1.7% with strongly emotional imagery.

(26)

Thus in our experiments, while the correspondence with the predominating type is close, unmixed imagery did not occur, nor did we find any evidence of a marked lack of imagery, although the various types of imagery vary in distinctness. While important in the analysis of mental functions and for application in pedagogy, it was not found of particular value in the majority of cases, among the adults tested, and was therefore discarded except in psychopathic cases.

The result of the imagery tests with 17 psychopathic individuals showed an increase in visuo-auditory imagery and a decrease in audito-visual imagery, and in the auditory images generally. Here we found 58% of visuo-auditory type, only 5% of the audito-visual type, 35% of the moto-visual type, and 5% of moto-emotional type. The tests therefore have value in diagnosis of psychopathic personalities, as we note deviations from normal here to an appreciable extent. The relationship of imagery type to the speech process was less apparent with normal individuals than other tests however, and are of little value in classification of types of speech disorder.

Betts (3) has shown that children employ much more imagery than adults. The child's mental horizon is a world of percepts covering the range of the senses. Only gradually does the meaning of the relation of objects themselves to other objects become apparent, when imagery gradually loses its important function. Language, playing as it does an important part in the process, serves more and more as a foundation for the meaning, and also aids in the reduction of the importance of imagery in logical thinking.

Imagery tests for children therefore may be more significant. Tests in spontaneous speech with 151 university students and 427 grade children indicate that there is temporary blocking of the imaginative processes in stutterers, psychopathic inferiors, children of a neurotic type, hysterics, excessively timid children, and those with feelings of inferiority. In such cases the type of expressional response becomes symptomatic. With the hysteric we may get a somatic type of reaction due to the instinctive cravings and suppression of the instincts, coupled with anxiety tensions.

Among so-called neurotics, often of brilliant intellect, we may find the expressive outlet taking on the coloring of an unstable emotional equilibrium. With the individual who suffers from feelings of inferiority, his speech may become an attempt at compensation, which breaks forth in the form of "megalomania," or excessive volubility. In most children we find a form of speech urge or speech pressure under conditions of emotional stress or animation. Thus with the neurotic, the speech reaction is merely the normal carried over into the extreme.

Hollingsworth (16) in testing psychoneurotics under hospital treatment used performance tests and such tests of mental functions as the digit span, cube imitation test, sentence completion and substitution tests. The object was to determine to what extent mental functions were impaired. In our tests with psychopaths we were attempting to determine which tests were most significant from the standpoint of the speech reaction.

In oral reading the median average rate for a group or 34 university students was 3.2 words per second, while the median average rate for 16 psychopaths was 2.8 words per second, showing a slight retardation in speed. This test was retained for inclusion in the final team of tests, as the relationship between such tests as rate in spontaneous speech and in oral reading was found to have a significant correlation index when compared with the subjective speech rating. Quantz has shown that fast readers are probably fast thinkers and fast speakers, and that speed of reading increases with age. Women read more rapidly than men usually. Whipple (37) discusses reading tests as an index of mental status. We find a high correlation between the subjective speech rating and oral and silent reading, as will be shown in discussing results of tests. (Chapter IV).

The use of Whipple's Nonsense Syllables for Visual Apprehension, and his tests of learning (digits and poetry), were used with 40 university students. We found here, also, that we were dealing with mental functions which were not vitally related to the speech reaction, as the results obtained were not indicative from a diagnostic point of view in the majority of cases. Errors were made by mispronunciation to such an extent that we did not find it satisfactory to use nonsense syllables in testing for the articulation of the various consonants and vowels. Wells (41) in using nonsense syllables, was testing auditory and visual perception of speech sounds. In order to test for articulation we found that with significant words we gained the more truly typical, habitual response.

W. S. Gray's tests for *comprehension* of material read were also given to a group of 40 university students and to 14 psychopaths at U. S. P. H. S. Hospital No. 37. The median average was 44.5 for normals, as compared with Starch's average of 50 for 8th grade (14-year old) pupils. Among psychopaths the score dropped to 28, showing the relationship between the integrative mental functions and the disturbance created by inability to concentrate and to perform the ordinary mental functions. In *reading ability* the score for 40 university students was 24.3, scoring according to Starch's method, the average being obtained from the computaton of rate or speed, and score for comprehension. With the psychopathic individuals the score dropped to 16.2. While the rate for silent reading was retained in the final working out of the team of tests, the comprehension and reading ability scores were not used, as they enter into the field of mental functions rather than into the field of speech, whereas there may be seen to be a high correlation between the speech rating of the individual and his score in silent and oral reading and in spontaneous speech.

Tests for auditory and visual memory span were discarded after trial in the groups already mentioned (40 university students and 17 psychopaths), because they were rather tests of mental functions than of speech reactions. The use of dissociated, unrelated objects and words was not found to be of particular diagnostic value except in indicating the involvement of the memory function in psychopathic individuals. With the greater number of cases with whom the speech teacher comes in contact, the memory span remains practically constant, according to the results obtained from testing 40 speech cases referred to the Speech Clinic, and does not deviate markedly from the norm set for unselected groups of individuals.

Whipple's Learning series was applied to determine the effect of practice upon the visual apprehension. This was tried with the following tests, for a period of six successive weeks, six trials being given in all: *Nonsense Syllables; Digits, Poetry, Memory for Objects.* Whipple shows that there should be an increase due to familiarity with the material, tricks of grouping, counting, etc. The tests given under standard conditions to a group of selected "speech defect" cases indicated that no progressive gain was made in their ability to recall the various symbols. The highest score in each test was made at about the mid-point in the testing period or about the third week. It then declined to the beginning point, and remained constant at that level to the end of the series. This test was not used in the final team of tests as it is also classified among the tests of mental functions, and is not the resultant of the auditory sensory impression.

Association Tests of Opposites were indicative of the reaction-time element, but did not vary in individuals showing speech defects from the norms set for unselected groups. The Jung and White Association Tests are frequently employed for analysis of psychic factors, but require too much time to be included in a team of tests to determine the effectiveness of the speech reaction. The standardized language ability tests were used but a short time, as they were believed to duplicate in function the work of other tests.

In order to determine the most rapid and at the same time a reasonably accurate method of estimating the size of vocabulary two methods were tried out. At the "Average Adult" level the individual should be able to define 65 in 100 words of the Terman vocabulary tests for adults. At "Superior Adult" level he should define 75 words. In a group of 60 university students (selected group consisting of students referred to the speech clinic, or who were speech majors or minors), the median average on Terman vocabulary tests was 70% defined. The median average for psychopaths was 61% defined, or somewhat below the average adult level.

The Whipple Vocabulary Test 77501 A. (37) of 100 words was given to the same groups, the student marking the words with a plus for words known, and a minus for words unknown. On this test the university students made a median score of 69.9% words known, while 17 psychopaths made a median score of 60.5 words defined in 100. So closely did the written estimate, according to the Whipple method, tally with the Terman standard for words verbally defined, that the Whipple method of marking words known and unknown was adopted for the final team of tests because of the shorter time required. While the Terman lists were adopted for the grades the Whipple word list was adopted for adults, the *marking* system of definition being used in both cases.

A study of the speech reaction to be effective should include some test in articulation aside from reading and verbal report tests, language, ability, vocabulary and the like. The various tests tried out up to this point in the working out of the problem seemed to indicate that good correlation might be obtained from a team of five to seven tests, including tests in articulation (of all the sounds in the language), rate in silent and oral reading and in spontaneous speech; percentage of relevant words used in a given speech response to a constant stimulus, and vocabulary. These tests were therefore used on a group of 111 university speech majors or minors or students referred to the department and therefore a selected group; also, on 40 unselected university students who had had no training in speech and no connection with the department, and who comprised two classes in Freshman English in which there occurred a scattering of upper classmen; and on all the children in each grade in eight grades (from I to VIII) from eight different schools, one grade being taken at random in each school. The grades and pupils tested therefore represent an unselected group and comprise a cross-section survey of the Madison Schools on 276 children.

Articulation tests were formulated to include the range of English consonant and vowel sounds as defined by the International

Phonetic Association (44). These were designed as a measuring scale for speech deviation. While no unsupplemented test in articulation is infallible as a measure of the usual speech reaction in a given case, the chances are strong for the inclusion of habitual inaccuracies within a test, provided the individual is not aware of the particular sound for which he is being tested. Test A was devised to include all the simple consonant and vowel sounds with the consonants arranged in initial, middle, and final positions, and in strong form. A second articulation test was arranged to measure consonant combinations, double or treble consonant formations, or sounds which are supposed to be more difficult of enunciation than simple consonant sounds, and which are later perfected.[1] These tests therefore somewhat overlap and, as might be anticipated, the score when high in Test A is usually high in Test B and vice versa.

With younger children however greater differences are found as the score on articulation of simple consonant sounds may run high, and yet a lower score be obtained for the articulation of such combinations as pr, br, skr, fl, ngst, mpt, bld, ks, tr, as they call for a greater dexterity in control of the speech musculature.

The difficulty of developing such tests is evident from the fact that one must take into account the position of the consonant as occurring in initial, middle, or final position; its position as strong or weak in form; the necessity of a corresponding list of sounds for the examiner with which to check; the advisability of concealing the test words in sentences so that the pupil shall not recognize the "test words" and therefore exercise extraordinary precaution in the matter of articulation and the necessity for brevity.

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[1] (1) Kussmaul, Ziemesen's Cycloped of Medicine, Vol. XIV, W. Wood & Co., N. Y., 1877. Prelim. Stages in lingual development, Chap. VI.

1. Spontaneous lalling, 4th to 7th week, while acquiring raw material of speech; cooing sounds, labial and lingual sounds and clicking sounds, first months.
2. Second preliminary stage of lingual development; 8 or 9 months, imitates sounds, then words heard from others, gradually arrives at echolalia. Narrowing of air column for vowels ah, oh, ay least difficulty while ee and oo require more energy.

(2) Behav. of the Human Infant during the First Thirty Days of Life. Margaret Gray Blanton, *Psychol. Rev.*, Vol. 24, No. 6, Nov. 1917. "Consonant sounds commonly heard are m in conjunction with a, as, mă (at), n as nhă (nat), g as gäh, h as hă (at), w in wăh (at), r as răh (at), r as in burr (very slight sound), and y as in yăh (at). Vowel sounds are o as owl, ē as in feel, ōō as in pool, ă as in an, and ä as in fäther (relatively rare).

(Sounds heard during the first thirty days.)

As an illustration of strong form we may quote Dr. Wyllie's (39) test sentences which have been frequently used in making studies of speech in various institutions. Here the consonants all occur in strong form, or in the stressed syllable. The test is incomplete in that the consonants occur only in initial position, and the test does not include all of the vowel sounds which are present in our language. Consonant sounds ch, j, ng, and hu (hj) are also missing.

> "*P*eter *B*rown *m*ade *wh*ite *w*ax.
> *F*ine *V*illages.
> *Th*inkest *th*ou *s*o *z*ealot,
> *Sh*e lei*s*urely *to*ok *d*own *n*ine *l*arge *r*oses.
> *C*an *G*ilbert *b*ring the Loch *H*ourn *y*ouths?"

When two consonants from the same phonetic group appear in succession in a word (as for instance *p*, *b*, or *m* made by the same position of the lips, but *b* vocalized, *p* non-vocalized, and *m* a nasal sound), one of the two consonants will be omitted or "weak" in ordinary speech. There is also the rule that when two consonants at the end of a word are hard to pronounce the second is often silent. Therefore, in the working out of test sentences it was found necessary to write the sentences in phonetic transcription to ascertain their value as test sounds.

At the outset an attempt was made to grade the tests in steps of one year each, from first to eighth grade. After a preliminary trial it was found advisable to rearrange the tests to conform to periods of growth. They were arranged therefore as a series of Educational Tests for school use by grades rather than by years.

It was found that the words originally included in the tests obtained from the graded lists of vocabulary of first and second grade children, as discussed in the Seventeenth Yearbook (1918), in various graded readers and spellers was too difficult for the reading knowledge of the average child in the grades for which the book was designed. In the upper grades many of the words were also mispronounced because of unfamiliarity. As it was desirable to eliminate difficulties in reading in order to check articulation the tests were set back two years and instead of sentences, it was found more satisfactory to use a picture test for articulation, in grades one, two and three.

The first written Articulation Test was therefore given in Grade IV. It was also found that the silent reading tests already standardized for Grades I and II were so difficult as to cause the time element to interfere seriously with the giving of the tests to large groups. Therefore silent and oral reading tests were not included until third grade was reached. These may be included in the giving of the tests wherever the operator has considerable time at his disposal and wishes to obtain the results for these tests as they are valuable for diagnostic purposes and are already standardized. In the early grades the child's attention becomes easily distracted and fatigue occurs, so that it was found desirable to limit the series of tests to 20-30 minutes performance. The tests selected were those which were easily within range of the child's abilities, and which should not fatigue him unduly, nor allow attention and interest to lag by forcing him on, nor discourage him by the use of difficult material such as silent and oral reading tests for grades I and II. Results for such tests can usually be obtained from the teacher at another sitting.

The tests finally chosen for standardization were:

1. Articulation Test A.
2. Articulation Test B.
3. Rate in Spontaneous Speech.
4. Rate in Oral Reading.
5. Rate in Silent Reading.
6. Percentage of Relevant Words (used in spontaneous speech).
7. Vocabulary.

These are fully described on the following pages, Part III, pp. 29-41.

SUMMARY

I. Previous studies have been based on sentences which did not include the entire range of English sounds. Former test sentences have followed the alphabet or written alphabet order. The proposed sentences offer satisfactory methods according to the standards set by the International Phonetic Association.

II. It is necessary to select the tests which seem to be most closely related to the speech process, in order to standardize and determine the relative importance of each test in a given series of speech tests.

PART III

Presentation of Testing Material

In a study of the speech reaction we are interested first of all in the general effectiveness or non-effectiveness of the speech response as a whole; the behavioristic attitude including postural tensions, specialized movements, tics, poise, bearing, control and emotional elements are the outstanding characteristics in the speech reaction upon which we instinctively base our first judgment in the measurement of individual responses.

Similarly we base our estimate upon the elements of quality, pitch, volume of tone (amplitude), and breath control. The time element may be definitely measured, and is included in Part II of the measurements. We further require a specific estimate of the individual's speech difficulty, if one exists, together with an analysis of the cause and condition.

Thus, a "subjective" estimate may be given by the examiner on an individual by rating the individual on a scale of one to ten, ten being high and one low, to indicate his position in the scale, relatively speaking.

With the grades it was found necessary to determine respiration by use of a standard tape measure while with university students and adults the spirometer was used. The use of spirometer measurements with grade children is uneconomical in point of time and results. It is more satisfactory and more accurate for adult measurements to use the spirometer however. The Spalding Wet Spirometer was used in the laboratory, and a standard tape measure was used in the grades.

The child was asked to repeat some simple sentence such as "I am going to play ball after school," while the experimenter noted his respiratory movements, placing the hands on upper chest and lower chest and then at chest and back, at the level of the shoulder blades, while child repeated the same sentence. With university students three measurements may be secured, one of quiet normal respiration breathing into the instrument the exhalation from a normal, quiet inhalation. Second, by preparing to speak as though about to say "In the far North stands a pine tree." The subject should think of the words he is about to say, and should say merely the first word "In," and then exhale the remainder of the unexpired breath into the instrument. The third measurement is of the chest capacity or vital capacity in which he is asked to take a practice breath and then to breath into the instrument sending the indicator just as high as he possibly can.

The final score in Part I represents the combined judgment of the speech examiner, and the teacher, on an individual, marking on a scale of one to ten.

This gives the experimenter a preliminary subjective estimate of the individual's speech before proceeding to the more exact portions of the examination in Part II where numerical values are assigned according to carefully weighted steps in a team of seven tests for which the values have been determined through the work of the regression equation and partial correlations.

Part I therefore is as follows:

(*Subjective Estimate*)

1. *General Behavioristic* Reaction.
    - A. Active controlled; active uncontrolled, apathetic-inert; phlegmatic.
    - B. Specialized muscle movements such as frowning, sprawling; extraneous muscle movements, or tics.
    - C. Postural tensions.
      General posture; physical anomalies, such as winging scapulae, protuberant abdomen; depressed torso, etc.
    - D. Emotional type.
      Social-adjustive; over-compensative; repressive; anxiety.
2. General Speech Reactions.
    - A. *Respiration.*
        - 1. Note same, if upper costal breathing or lower costal breathing is distinctly predominant, or if no distinction can be made.
        - 2. Measurements. Upper costal deflated: Inflated.
          Lower costal deflated: Inflated.
          Vital capacity
          Spirometer.
    - B. *Voice.*
        - 1. Quality.
          Resonant; unresonant, harsh, nasal, hoarse.
        - 2. Pitch. Good range; monotony; extremely high or low.
        - 3. Volume. Tones loud, soft, medium, inaudible.
    - C. *Fundamental Speech* Reaction.
      Defects or deviations from standard already noted.

Score................

Grade on a scale of 1 to 10. Ten is highest and one lowest in scale (p. 140).

This constitutes the examiner's subjective estimate of the effectiveness of the speech reaction previous to the measurement by objective tests as contained in Part II of the speech rating blank.

The objective measurements in Part II represent a series of carefully weighted tests, or a team of tests upon which a speech score may be obtained and which may be compared with the subjective rating given by the examiner previous to the giving of the team of tests. While the form of the tests is substantially the same it was found necessary to grade the Articulation Tests from preschool age and Grades I, II, and III to Grade VIII. The tests given above Grade VIII are those prepared for university students or speech cases over fourteen years of age, as no tests were given to a high school group. It was also found necessary to vary the pictures used for obtaining a spontaneous speech reaction, and the pictures with which the best reactions were obtained are therefore included (by permission of the publishers) in the testing material.

To obtain a measurement of the rate in oral and silent reading, previously standardized material was used. In Grades III to VIII W. S. Gray's Graded Oral Reading tests were used. In Grades III to VIII and also in the university group Starch's graded series of silent reading tests were used. For the university group in oral reading Whipple's Plain Prose Reading Test was used.

In the grades the Terman Vocabulary Tests were used, while for adults the Whipple Tests were found more satisfactory.

The Tests for Objective Measurements Part II are as follows:

A. Articulation Test A. (Test No. 1 in series). This contains the list of sounds given by the International Phonetic Association as covering the range of consonant and vowel sounds used in the English language. A few consonant combinations have been included where the consonant has less than three positions (i.e., when it does not occur in initial, middle, and final position), and the total number of sounds is therefore 100, three points being allowed for each sentence, which contains three test sounds, except the final sentence which contains but one test sound. The articulation tests for each grade are therefore scored on a scale of 100 points, the pupil reading the sentences while the examiner checks the corresponding or test sound on the scoring sheet.

B. Articulation Test B. (Test No. 2 in series), contains a set of the consonant combinations in double, treble, or quadruple formation which are most frequently used, and which cover the range of articulatory movements necessary for ordinary speech. This, of course, duplicates the work performed by Articulation Test A, it being merely a refinement of the same and requiring greater dexterity in the use of the speech mechanism. The combinations are most difficult and the errors more numerous in the early grades. With upper grades and adults they should present no difficulty unless certain consonants contained in a given combination have also been inaccurate in Test A because of habitual error upon a given consonant.

Articulation Test B is graded on a scale of 100, five points being allowed to each sentence. If there be but one type of error in sentence deduct two points for each error. If three type errors occur in the sentence five points should be deducted. The total score for the 20 sentences is therefore 100. Only the errors noted on the examiner's sheet should be checked as this is a measure of certain type sounds.

C. For rate in spontaneous speech (Test No. 3 in series) find the number of words which the subject gives in thirty seconds in response to these directions: "You like to look at pictures, don't you? Well I am going to show you a picture which will make you think of something you have done or seen somewhere when you have been playing, or in your home or at school. As soon as you see the picture, which I will let you take to look at all the time you are talking about it, I want you to tell me about anything that the picture makes you think of. Are you ready? Very well. Now!"

It may be necessary to start again by saying: "Do not describe the picture or what is in it, but tell me what it makes you think, about things you have done, places you have seen, or something you have read, or heard about."

In some instances it will be found that one or two pictures are not sufficiently stimulating to secure a response. It may be necessary to use as many as five pictures in order to secure a representative sampling of the child's ordinary speech. In these cases there is usually a repressive element; slow, deliberate thinking; or poverty of expression and lack of imagination. The fact that it is necessary to use more than the two pictures, which secure responses from the majority of the children in a given grade, is usually significant and should be noted.

The child often shows carelessness in following directions, and responds by describing the picture. Such a response should be graded lower than the self-reference type. If, when he is given a second picture and directions are repeated, he still continues to give descriptions, use one of the pictures such as the Three Bears, or Red Riding Hood, in which he may retell the story as he recalls it.

For first and second grade children this is the type or response which one usually obtains, as the child's experiences are yet rather limited, and his associative resources meagre. He either responds by describing the objects in the picture or by wishing to tell the story it contains. The rate in retelling the story is more rapid than truly spontaneous speech, but descriptions or story responses may be accepted in Grades one and two. Differences in nationality are significant in the results obtained from various groups. We found the Norwegian and German children especially prone to give descriptions or to respond by giving a story rather than by giving introspective responses connected with their own experiences. Imaginative thinking was much less in evidence in the responses of such children, than among those of Scotch, English, Irish, or Italian descent.

The writer secured the exact number of words given in 30 seconds, by recording in shorthand the number of words given, using a stop-watch for time measurement. The number obtained in 30 seconds, multiplied by 2 gives the number of words per minute.

The writer further classified the responses in one of three ways. According to the quality of the response it was classified as superior, average, or inferior, and samples of the various types are given with the tests. The examiner may obtain his estimate by comparing the response of a given individual with the sample given.

D. The score for Oral Reading (Test No. 4 in series) is obtained by using a stop-watch and obtaining the number of words which the reader covers in 30 seconds. Dividing by 30 will give the speed per second. The score is the number read per minute, or the score per second multiplied by 60. This is simplified if the examiner holds a duplicate copy of the material read, the words at end of the lines being numbered. The pupil receives the instructions that he is to read at his ordinary rate of speed, and just as nearly as possible as he would read aloud at any time under ordinary conditions.

The oral reading tests are graded, the W. S. Gray tests being used for this purpose from third to eighth grade. We gave up the attempt to use them in first and second because they were found to be too difficult for the majority of the children in those grades, and the time element interfered with giving them properly. It is desirable whenever possible to have the teacher for the grade give the tests at another sitting, in oral and silent reading where one is using the team of tests in grades one and two.

E. The rate in silent reading (Test No. 5 in series) was obtained by giving the child these directions: "I am going to give you something to read silently, at the rate at which you ordinarily read. Read it carefully enough so that you could tell me what is in the passage. Start when I say start and stop when I say stop. I will ask you to show me the word you were reading when I said stop."

The score is the number of words read per minute. The pupil reads for thirty seconds, at the end of which time the examiner says "stop," and counts the number of words given in 30 seconds. This number divided by 30 gives the number per second. This figure multiplied by 60 gives the number per minute. If the speed is such as to arouse suspicions as to the comprehension and reading ability the pupil is asked to give verbally an account of what he has read. With psychopaths and various individuals this is often necessary. The Starch Graded Tests in Silent Reading are used for silent reading through the grades and with adults or university group. This test was not found satisfactory in first and second grades, but whenever possible should be given by the teacher at another sitting because of the time element and the difficulty involved in giving it with a series of tests.

F. To obtain the percentage of relevant words (Test No. 6 in series) used in spontaneous speech the writer during the giving of the Spontaneous Speech Test, after the rate per minute had been obtained, secured the number of recurrent and irrelevant words occurring in a sampling of speech of 60 seconds' duration. The connective "and" is almost universally used in such responses and it is a question whether or not it should be accepted as natural. It is not present however in the most polished speech, nor in good written composition, and it seems that this should determine our standard therefore. Such expressions as "and," "very," "of course," besides various superlatives which are more frequent with women than men, or "fillers-in" such as "Well," "Say," or "Oh say," "listen," and the like, were recorded. If the examiner is not able to take verbatim the number of words given in spontaneous speech, he may easily record the irrelevant words or expressions which are given in 60 seconds, and this may be deducted from the total number of words which the pupil has been found to give per minute. This gives the number of relevant words. The *percentage* of relevant words is obtained by dividing the number of relevant words by the number of words per minute. Thus, if an individual gives 120 words per minute in spontaneous speech, and in another sampling gives 7 irrelevant words, we may substract 7 from 120 and the remainder is 113 or the number of relevant words. If we divide 113 by 120 we have .94 or 94% relevant words. (The number of words given per second may be recorded by a system of dots in a given sampling of speech for 30 seconds, when the experimenter cannot take it verbatim and has no stenographic assistant.)

The writer took three samples of spontaneous speech from each of the adult group, using three successive pictures, and to obtain an adequate speech response upon which to base further testing it was found that 30 seconds was usually sufficient to obtain a fair sampling of the spontaneous speech reaction. It was sometimes necessary to wait until after the speech reaction had been started and speech was reasonably fluent, that is, after some 5 to 15 seconds before taking the record of words given in 30 seconds.

Vocabulary. (Test No. 7 in series.)

The standards given by Terman for the different years, as determined by the vocabulary reached by 60 to 65 percent of the subjects of various mental levels are:

5-7 years	6 words	defined in terms of use.
8 years	20 words	vocabulary 3,600
10 years	30 words	vocabulary 5,400
12 years	40 words	vocabulary 7,200
14 years	50 words	vocabulary 9,000
Average adult	65 words	vocabulary 11,700
Superior adult	75 words	vocabulary 13,500

Terman's method permits one to give the above test in group form by allowing the child to mark the words himself, rather than give a verbal response, when desirable. Terman prefers the oral method of response to the written, but when included in a mixed team of tests it is a great advantage in point of time, to give the test as a group test in the school room, the examiner preferably giving the test rather than the teacher, using standardized formula for conducting the same.

"When the response is given verbally a safe rule to follow is to continue until eight or ten successive words have been missed and to score the remainder minus without giving them" (p. 225) (Terman). If teacher and speech examiner are both in the room this procedure may be followed by asking the child to stop writing, when the examiner sees from a glance at his paper that he is no longer able to define the words and is marking them all minus.

The test when given in group form by grades is given rather as an educational test than as intelligence test in the Terman interpretation of the same. The results will therefore be significant for grades rather than for years, as the older children will usually be found to have better vocabularies. Because of the high coefficient of correlation between the vocabulary and the speech rating we feel that it is important to include the vocabulary test in the team of tests for each grade.

With adults and those above eighth grade the Whipple Vocabulary Test has been used because of the simplified arrangement and because it is in some ways better adapted to the performance of the university student.

The same list of words is used throughout the grades, or from

Grades III to VIII. In Grades I and II the list of six words for definition given by Terman was used.

SUMMARY

I. A team of objective measurements enables the examiner to check up his subjective rating of an individual's speech reaction according to predetermined standards.

II. The conditions for giving the tests may somewhat effect the type of reaction, as in Articulation and Spontaneous speech, but such factors as rate, quality and time remain practically constant, and artificial reactions do not usually persist throughout the test series. Thus a fair or average sampling of the speech reaction in Articulation and spontaneous speech may be obtained, in addition to scores in oral reading, silent reading and vocabulary.

SUPPLEMENT TO PART III

This section gives a brief summary of the series of graded speech tests which may be used as educational measurements. The entire set of testing material for use from pre-school age, through the grades from first to eighth, with a final or adult test, will be published through C. H. Stoelting & Co., Chicago, Ill.

Complete Speech Measurement Rating Sheet

Name............................ Grade........ Age........ Sex........
Language spoken in home............................
First language spoken by child..........................

PART I. (*Subjective estimate*).
1. General behavioristic reaction.
    A. Active controlled; active uncontrolled; apathetic-inert; phlegmatic.
    B. Specialized muscle movements such as frowning, sprawling, extraneous muscle movements, or tics.
    C. Postural tensions: physical anomalies; winging scapulae; protuberant abdomen; depressed torso.
    D. Emotional type. Social-adjustive; over-compensative; repressive; anxiety.
2. General speech reactions.
    A. Respiration. 1. Upper costal predominant.
        2. Lower costal predominant.
        3. Measurements: upper costal deflated;
            " " inflated;
            lower costal deflated;
            " " inflated.
            Vital capacity.
            Spirometer measurements.

B. Voice.
  1. Quality. Resonant; unresonant; harsh; hoarse; nasal.
  2. Pitch. Good range; monotonous; extremely high or low.
  3. Volume of tone. Loud; soft; inaudible; medium.

C. Fundamental speech type.
  Subjective speech rating. (On scale of 1 to 10). 10 high: 1 low.

PART II. *Objective measurements.*

3. Reactions in a team of seven tests.

A. Score in Articulation Test A.	....	(Multiply by 5).......
B. Score in Articulation Test B.	....	" " 7 ....
C. Score in Rate for Spontaneous Speech (words per minute)	....	" " 2 ....
D. Score in Oral Reading Rate.......	....	" " 3 ....
E. Score in Silent Reading Rate	....	" " 3 ....
F. Percentage of Relevant Words (in spontaneous speech)	....	" " 50 ....
G. Vocabulary	....	" " 10 ....
		Total...........

Treatment of results: From the total score, the amount of 6950 must be subtracted. This equals........... Divide this by 100 to reduce to the original terms, and the result is the speech index........... This usually corresponds within a few digits with the subjective speech estimate found by the examiner at the beginning of the test (Part I). There will be some shrinkage, due to the figures being applied to a different group than those on which the original norms were obtained.

Sample Responses in Adult Spontaneous Speech Test

I. *Superior response.*

(The picture on which the response is based is The American Bald Eagle.)

This picture reminds me of the posters that were given out, on the day of President Wilson's arrival in Italy. The posters had printed on them in Italian the fourteen cardinal points made by Mr. Wilson concerning reparations. The posters, as I recall it, had at the head a picture of Wilson, and the American eagle on one side, and the flag below. I recall many people standing around in great agitation, talking about it, and I also have in mind the ragged little youngster who handed one of the posters to me.

II. *Satisfactory or average response.*

I think of the story of Old Abe, the eagle of the Wisconsin wars. I recall how it was found by an Indian War Chief, and went through the war with some of our soldiers, and finally died. It was mounted, and placed in the old State Capitol. It was there when the place was burned, after being struck by lightning. When I was a boy, Old Abe used to be quite a "hero" to the children of the state.

III. *Poor response.*

Ah! This is the good old American Eagle. This is good Old Glory. Er— er— er—. This picture of the Eagle and the flag is something I have often seen. This flag of course is always a good background, and during the war it was frequently displayed wherever you looked. The Eagle, just why— er— er— just why it was chosen to symbolize America, I don't know. I imagine— er— er— because he is a good fighter. The eagle reminds me of the boys during the war who were the first to advance toward the enemy, and who came back and fought and became better American citizens. I— er— er— that is all I think of.

Specimen Final Rating Sheet No. 1

Part I. Examiner's estimate for the Subjective Rating factors, in part one, on a given individual, was 10.

Part II. The scores made in Objective Measurements, in part two, were as follows:

Test I.	Score 100	(x 5,	its	appropriate	weight)	equals	500
Test II.	Score 100	(x 7,	“	“	“	“	700
Test III.	Score 102	(x 2,	“	“	“	“	204
Test IV.	Score 156	(x 3,	“	“	“	“	468
Test V.	Score 192	(x 3,	“	“	“	“	576
Test VI.	Score 96%	(x50,	“	“	“	“	4800
Test VII.	Score 83	(x10,	“	“	“	“	830
						Total score......	8078
						—	6950
						100)	1128
						Speech index is	11

(Cf. with examiner's estimate at beginning of Part I.)

Specimen Rating Sheet No. 2

Part I. Examiner's estimate, combined with that of a second judge, was in this case 18.

Part II. The scores made by this student on Objective Measurements:

Test I.	97x 5	equals	485
Test II.	100x 7	“	700
Test III.	102x 2	“	204
Test IV.	180x 3	“	540
Test V.	360x 3	“	1080
Test VI.	100x50	“	5000
Test VII.	80x10	“	800
	Total score......		8809
		—	6950
		100)	1858
			18 Speech index.

(Cf. with estimate found at beginning of test, Part I.)

Note: In the majority of cases the correspondence between subjective and objective rating is very close. There will be some shrinkage when the norms are applied to a different group. There are, moreover, occasional cases wherein there seems to be very little correspondence between the subjective rating awarded an individual by the examiner, and the score made in the team of tests. In such cases no attempt should be made to combine the scores, but each should be kept separately for Part I and Part II of the tests. It is possible that they may be altered later by observation. Differences in judgment of the various examiners also causes this part of the test to vary.*

The Complete Speech Measurement Rating Sheet is divided into two sections. Part I contains those subjective factors which are based on judgments concerning the behavioristic reaction, emotional type, specialized useless muscle movements, tics, postural tensions, physical anomalies, vocal quality, pitch, volume and respiration.

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*Hollingworth, H. L. Judging Human Character. N. Y.: D. Appleton & Co., 1922, pp. 45-49.

The individual is given a speech rating based on these factors, on a graded scale of 1 to 10, viz.: superior, above average, average, below average, inferior (as in mutism and absence of speech, or mental deficiency).

Part II consists of a team of seven weighted tests or objective measurements, which can be subjected to a numerical rating. These tests are weighted according to their significance as compared with the subjective speech rating in Part I. These tests are: Articulation Test A, Articulation Test B, Oral Reading Rate, Silent Reading Rate, Rate in Spontaneous Speech, Percentage of Relevant Words used in Spontaneous Speech, and Vocabulary.

TEST 1. Articulation Test A. consists of a series of sentences in which all the consonants and vowel sounds in the language occur. The consonants appear in initial, middle and final position and in strong form. The sounds are those listed by the International Phonetic Association, as the sounds occuring in the English language. The test is graded on a scale of 100.

TEST 2. Articulation Test B. consists of the common consonant combinations, the sentences being rather more difficult for articulation than those which contain the simple consonant and vowel sounds (in Test A). Jones' English Pronouncing Dictionary was used as final authority in working out the phonetic transcriptions of the test words, the use of the sounds in sentences tending to conceal the test word from the reader, so that the experimenter may more easily catch the habitual types of errors than as though merely lists of test words are used.

The third test in the team of objective measurements, is a standardized oral reading test, this being also graded, so that a different test for each grade is provided.

The fourth, or Silent Reading Test, is standardized by grades, with a different test for each grade.

For the fifth, or Spontaneous Speech Test, it was necessary to develop the technique, using a uniform method of stimulus and control. A series of pictures is used for obtaining the Speech Reaction, the pictures being graded, according to the age, interests and mental development of the child. The pictures used for standardization were those which secured a satisfactory response from at least 65% of the children in each grade.

The sixth test, Percentage of Relevant Words Used in Spontaneous Speech, is found to bear a very high correlation, when compared with the subjective speech rating. The measurement is based upon the same picture stimulus which is used for obtaining spontaneous speech rate, in a given grade.

For the seventh test, Vocabulary, a standardized test for children in the early grades was used. For the upper grades, a test previously standardized, and usable from third to eighth grade, was included. This may be given as a group test. For those above eighth grade an adult test is used, which may also be given as a group test.

A standard tape measure was used for securing chest measurements in the grades. A wet spirometer was used for securing the respiratory measurements of university students and adults.

The time reaction was measured by using a stop-watch (showing fifths of a second).

PART IV*

Interpretation of Experimental Results

1. Scope and method.
2. Formulas employed.
3. Findings.

In a survey of the field of linguistic psychology speech lapses, and speech reactions, there exists very little experimental data with which to compare the results obtained in this investigation. Extended research over a longer period of time and with a larger group is necessary to establish the preliminary evidence which has been obtained in the working out of this monograph.

Wells (41), in his study of Linguistic Lapses, has given us a careful study of the relationship between mishearing (x) and erroneous substitution (y) as determined by the Pearson products-moment method.

He has also plotted curves to show the effect of practice upon accuracy in the mastery of speech sounds. In his tests he has employed carefully formulated nonsense-syllables because of the associo-suggestive factor which he believes may offset the results in the case of significant stimuli present in test words of known form. Dispersal of attention is also aimed at by this form of test.

In our sentences, while giving weight to the position of the consonant as initial, middle, or final, we have taken into consideration its position as strong or weak, and the suggestive element is lessened by the fact that the sentences are not alphabetically arranged, while the test words are obscured except to the experimenter. We wish to obtain a measurement of what the actual performance of the individual is, in his ordinary speech reactions; to check *not* for *mispronunciations* (which occurred frequently in our use of nonsense syllables), but for mutations or alterations in the character

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*I am indebted for direction and help in statistical computations to the statisticians in the Department of Psychology of the University of Wisconsin.
S. M. S.

of words and of vowels or consonants themselves, in various test words which compare favorably with their use in ordinary speech.

Table I gives the median averages and standard deviations obtained in a cross-section study of eight grades, ranging from first to eight and including all the children in a given grade. The grades represent entirely unselected groups, being chosen at random one grade from each of eight schools. The university normal group represents the same type of unselected student group, two classes in Freshman English being chosen, none of whom had been enrolled in the Speech Department of the university either for training or diagnosis. A scattering of upper classmen was present in the group which represents an unselected group of freshman English students from various departments such as engineering, commerce, liberal arts, home economics, and agriculture. For comparative purposes the statistics on a *selected* group of 111 students in the Speech Department is included. These results represent students referred to the Corrective Speech Clinic for diagnosis, or speech analyses, being either students in the department or cases referred for diagnosis and training. The differences between the "normal control" speech group and the "speech training" group are suggestive.

In order to find the correlation coefficients for a set of variables and to determine the relative importance of the different tests, it was necessary to find the relationship between the subjective speech rating for each individual in a given group, and his numerical or objective rating in a given test. A team of seven tests was used in each grade from first to eighth, and with two university groups.

The subjective rating was obtained by reducing to a common scale the estimates of two persons on a given pupil. The teacher was asked to grade her pupils on a basis of 1 to 10, ten being high and 1 being low. The writer also made a speech prediction on the speech reaction of the individuals tested also on a basis of 1 to 10, the estimate being derived from the purely subjective features in the test sheet contained in Part I of the examination sheet. A speech score was thus given, or speech prediction which was a combination of the combined judgments of two persons in regard to a given individual as to his speech performance. This estimate was

TABLE I

Med. Av.—Median Average.
S. D.—Standard Deviation

	Test A		Test B		Rate in Spon Sp.		Rate in Oral R.		Rate in Silent R.		% Relev. Words		Vocab.		No. of Pupils
	Med. Av.	S. D.	Med. Av.	S. D.	Med. Av.	S. D.	Med. Av.	S. D.	Med. Av.	S. D.	Med. Av.	S. D.	Med. Av.	S. D.	
Grade I	97	11.2			120	24.5					96%	4.4	6	.57	36
Grade II	97	5.8			120	14.9					95%	3.1	6	11.4	38
Grade III	98	4.2	97	3.6	108	29.2	144	48.8	138	66.7	90%	3.0	30	12.0	39
Grade IV	96	4.1	97	7.2	108	34.5	156	53.6	246	85.5	93%	7.6	29	11.2	38
Grade V	96	6.2	93	8.1	108	27.2	204	61.8	186	62.9	90%	10.1	48	9.3	39
Grade VI	96	3.3	97	5	120	27.8	174	37.0	222	64.5	95%	9.5	47	10.8	28
Grade VII	96	4.8	94	7	138	22.5	153	28.7	207	61.1	91%	5.6	53	8.5	22
Grade VIII	97	4.7	95	7.1	129	21.1	150	40.5	255	66.5	93%	4.1	60	7.4	36
Univ. students unselected	97.5	3.36	97.5	5.09	120	7.8	276	71.2	204	8.65	96%	3.76	73.5	10.8	40
Univ. selected group speech cases	93	7.53	94	11.3	120	38.2	186	45.2	258	87.2	93%	4.5	72	10.8	111

Total 426

made and recorded before the objective features of the test were rated or their numerical values found.

Certain features which are extremely important in forming any estimate of the total speech reaction do not lend themselves to estimates based on mathematical formulae, yet are important in diagnosing and eliminating errors in speech. These may therefore be said to constitute the subjective factors in the speech reaction, and when the experimentation is carried on with a sufficient number of individuals by the same experimenter, using uniform methods, the estimates or subjective ratings for different individuals may be considered accurate enough for carrying on further investigations based on such subjective ratings.

In order to give an individual a proper rating however it is desirable to have more than the estimate of speech effectiveness or the speech prediction made upon subjectives factors. The possibility of formulating any such method has not previously been attempted so far as we have been able to determine in a review of the literature in speech studies. Moreover, it has been the firm conviction of specialists in the field of speech and oratory that such tests, when given a numerical value, would fail to conform to the actual estimates given by a subjective estimate of the speaker's effectiveness.

The answer to such objections is that after working out the regression equations and securing the proper weighting for each test we have found that the final score for objective measurements in a team of seven tests (Part II) corresponds within a few points to the "guess" work or estimate of the individual on the subjective factors in the speech reaction (Part I) assigned at the beginning of the analysis of the speech reaction. In other words, our speech prediction, or estimate of one's performance (based on objectively unmeasurable factors, all of which we feel are closely allied to the speech factors which can be definitely measured), should tally within a small range of variation.

The raw score for each test in the team of tests must be multiplied by a certain assigned *weight* for the test as determined by the regression equation. There will be a slight shrinkage when they are given to another group.

The working out of the coefficients of correlation between the speech rating and the various tests may show a correlation between 1 and 2, and between 1 and 3, and if this is the case there would be found a correlation between 2 and 3 even though no close relationship between 2 and 3 exists, because they are both correlated to 1. The working out of the partial correlations for the entire team of tests eliminates the influence of one test upon another. Thus, in the zero correlation between articulation Test A and Subjective Rating we find the correlation to be +.385 (Table IV, p. 68). Part of this is due to the influence of some other factor than articulation as found in Test A. When we have eliminated the effect of all the other tests upon it we have only +.032 instead of +.385 remaining for our final correlation coefficient. This indicates that the work of articulation is duplicated in the other tests, such as spontaneous speech and oral reading, as we might expect, but we cannot eliminate this test from our team even though we can assign it but a small weight because it is more important to the diagnosis of our speech difficulty than any test in the group, and while we may by chance notice certain errors of speech and faulty sounds or substitutions in the casual reading of a selection, it is impossible for the experimenter to concentrate upon the checking of more than one factor at a time. Thus, while vocabulary and percentage of relevant words may be more important numerically in the weighting of the tests, we shall have to retain even the tests which are found to infringe somewhat upon the works performed by the other tests in the team, because of their diagnostic value.

The standard deviations and the median averages for each test were computed as shown in Table I. The median average was used rather than the arithmetical average as being the more accurate in a small group. The median averages serve as our temporary norms for each grade, and tables are given for purposes of comparison, showing their approach to the norm already established in standardized tests such as oral and silent reading and in vocabulary. Thus, in simplified form the values given in Table III are the temporary norms for the speech tests in Grades I to VIII, and for adults beyond public school age. No attempt has yet been made to grade the adult tests.

To find the coefficient of correlation between the subjective rating and the scores in the various tests the Pearson formula was used, $r = \frac{\Sigma xy}{n . \sqrt{\sigma x} . \sqrt{\sigma y}}$.

Thus in Grade III, in determining the correlation coefficient between subjective rating and oral reading rate, we find a correlation of +.487 (i.e., a positive relationship between oral reading rate and subjective speech, or a good rating in this grade). The findings are represented in Table II for this formula as applied to tests given throughout the series.

It may be that when the tests are given to a large number of individuals these values will change somewhat. They are bound to vary somewhat due to variations in marking or checking inaccuracies by different examiners.

One can readily see by a study of Table II that there are varying degrees of relationship between the several tests and the subjective judgment of the speech process. Were these tests to be given to any one individual and the scores on the several tests given equal weight, the total score would not then be an accurate index of an individual's speech ability, for he might achieve a high rating in some test that was relatively less significant than the others, and achieve a low rating in a test that was related in a high degree to general speech ability.

Furthermore, the several tests are doubtless overlapping in the particular functions that they test, so that one must measure the influence of one test upon another as expressed in the correlations on Table II, and knowing the value of this influence, determine the relative value of each of these tests in the measurement of significant speech functions. This process is called "weighting," and the formula used is Yule's formula for the regression equation (42).

After working out the regression equation, we obtain the values for weighting the tests in final form.

It is significant that a relatively heavy weighting is necessary for the silent reading test, which corresponds to the findings of

Table II

Zero coefficients, unweighted, showing relationship between scores of pupils in different grades, and the criterion, (subjective speech ating), in a team of seven tests.

Subjective Speech Rating and—	Test A	Test B	Rate in Spon. Sp.	Rate in Oral R.	Rate in Silent R.	% of Rele. Wds.	Vocab.	No. of Pupils
Grade I	.62		.05			.22	.23	36
Grade II	.50		.10			.17	.13	38
Grade III	.34	.015	.27	.487	.17	.016	.16	39
Grade IV	.099	.19	-.05	.53	.53	.27	.44	38
Grade V	.26	.41	.62	.38	.35	.42	.16	39
Grade VI	.09	.003	.061	.05	.05	.20	.39	28
Grade VII	.56	.56	.33	.51	.63	.22	.25	22
Grade VIII	.34	.43	-.27	.22	.33	.56	.15	36
Univ. unselected group (40)	.385	.251	.258	.211	.588	.494	.428	40
Average	.354	.265	.223	.341	.378	.285	.259	
Univ. selected group, 111 speech cases	.64	.457	.308	.334	.369	.391	.34	111

Watson in the importance which he attaches to implicit or silent speech in the adult, as compared with explicit or overt speech in childhood. In all except sixth grade a high positive correlation was found for silent reading in each grade ranging from +.17 to +.63 (Table II, p. 61), and if tried for larger groups we find that the tendency is somewhat reduced. In a group of 111 *speech* cases we find the correlation to be but +.369 as compared with the coefficient of +.588 obtained for 40 *non-speech* university cases.

The highest amount of weighting is necessary for the percentage of relevant words obtained in the Test for Spontaneous Speech. In all except the third grade, this shows a plus correlation varying from +.17 to +.56. In third grade it is believed that the absence of any correlation in this test is due to the experimenter's difficulty in securing an adequate speech response. In grades one, two and three it was necessary to work out a method rather different from that used for upper grades for securing the confidence and interest of pupils, and to lead children to given adequate responses within the allotted time. In grades one, two and three but brief responses are given, and it was found necessary to use imaginative appeals to the child's thinking, and often the only response which it was possible to obtain was the retelling of a story, for which the picture served as a reminder, as pictures of unfamiliar material or of detached incidents did not secure any adequate response. A response containing the retelling of a familiar story such as the Three Bears (but *not* of material already committed to memory, as in nursery rhymes, etc.), was accepted when no other response could be secured. This accounts for the rapid rate of 120 words which was the median for this grade. Further experimentation is necessary for the obtaining of accurate measurements of spontaneous speech in the early grades and pre-school period. Requiring the child to respond under artificial conditions at once hampers his power of expression and interferes with spontaneity, and of all the pictures used as a control to stimulate speech response, the only satisfactory ones for grades one and two were those picturing some story with which the child was familiar, such as Red Riding Hood, or the Three Bears. The power of abstraction and reasoning is still too undeveloped to enable the child to see anything in the picture other than the object itself. He cannot yet relate it to his experiences. The type of responses given in Grade Three in Spontaneous Speech seems to indicate a transition stage between the power of abstraction, the ability to generalize, and to respond to imaginative stimulus sufficiently to discuss the theme of the picture, and the earlier stage shown in Grade one. The picture of a bear or of a lion, to Grade one children, suggests just that and nothing more. The response may be "That's a bear," "I saw one once," and no further response may be elicited, but if the picture is given in an imaginative setting and he sees the three bears just returning to their cottage, gazing upon the sleeping Goldie Locks, then a troup of visual impressions stimulate the child until he seeks expression in overt speech, and he hastens to tell the story of The Three Bears. Whether the reaction be impulsive, deliberate, phlegmatic, ordinary in type, depends upon the type of individual as well as upon the vividness of the stimulus and its association with other images. Unless the stimulus is sufficient to stir associative images, we may get short-circuited, abbreviated, monosyllabic and incomplete verbal responses incapable of time measurement or analysis.

In order to ascertain the value of the Articulation Tests A and B when given by themselves, they were compared with the Criterion (Subjective Rating) eliminating the influence of all other tests (Table IV), and it was found that the work of Articulation Test A is duplicated largely by the work of Articulation Test B and that there is no special advantage in using both tests, as Test A practically performs all the work that may be done by using both tests. When A is compared with subjective rating, the coefficient of correlation is +.385; when Both A and B are used the coefficient of correlation is +.390; consequently Articulation Test A may be used as a separate test for diagnostic purposes when it is desirable to avoid giving the entire team of tests, and one wishes merely to ascertain the errors in articulation.

Note: The following values were found by comparing Tests A and B with subjective rating eliminating the influence of all other tests (Table IV, p. 68):

$$r_{1\,\&\,2} = +.385$$

$$r_{2\,\&\,3} = +.794$$

$$r_{1\,\&\,3} = +.251$$

$$R_{1\,2\,\&\,3} = +.390$$

Table III represents the temporary norms obtained for the team of seven tests. These will need eventually to be modified, when a larger number of speech tests for each grade has been given. For the purpose of further standardization the norms here obtained are reliable as applied to the average grade in a city school. In Vocabulary tests it will be observed that the norms obtained for even a small group do not differ very widely from the norms found by Terman for a much larger group.

It has been previously estimated, through the study of abnormal speech, that the average rate for normals, in spontaneous speech ranges from 120 to 150 words per minute. The findings in our tests conform to these standards except in the earlier grades. Here it drops to about 108 words per minute.

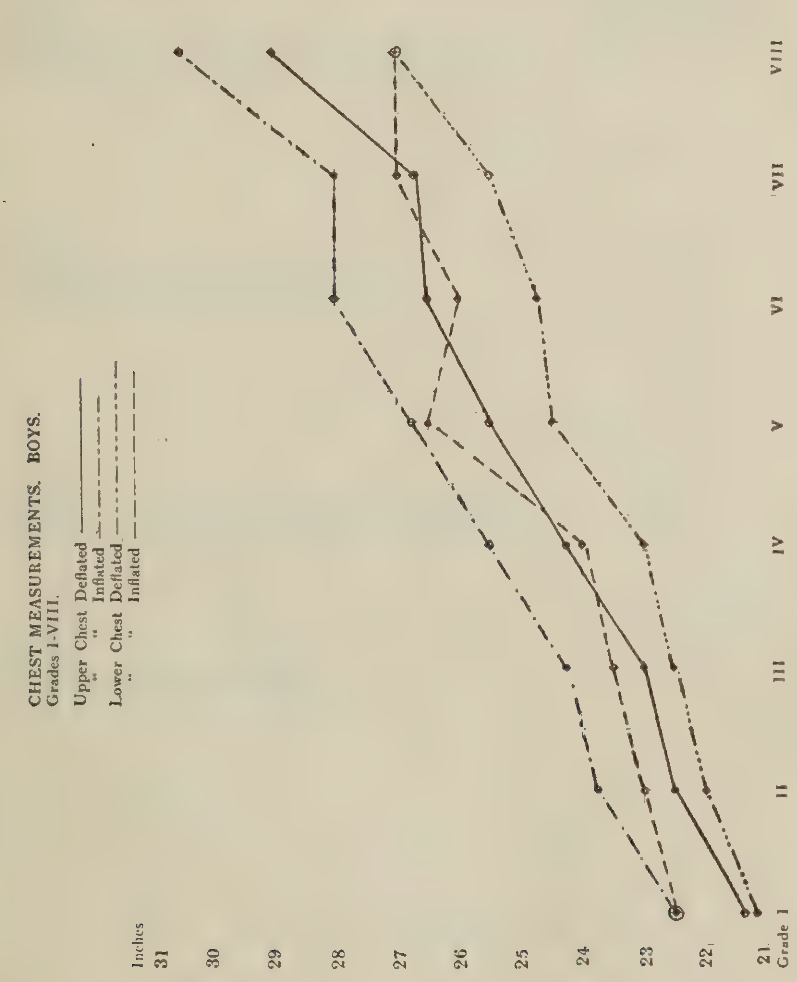
The average scores in Articulation are high, and vary little from grade to grade. This is to be expected, when one considers that it is only in cases of marked deviation from speech standards, or in cases of speech defect that we should expect to encounter numerous difficulties in the enunciation of the consonant and vowel sounds. The scores in Oral and Silent Reading may be compared with those found by Gray and Starch in these tests, if one wishes to ascertain the upper and lower ranges which are acceptable.

In grades three, four and five, where the rate in spontaneous speech slows up slightly, we find that the percentage of relevant words obtained, is also less. This is the period during which the child is gradually increasing in ability to use reason and logic. He is able to give a response superior to that of repetition of a story, or descriptions of an object in terms of use, and begins now to form associations connected with his own experiences, upon which he may draw, in response to the proper stimulus.

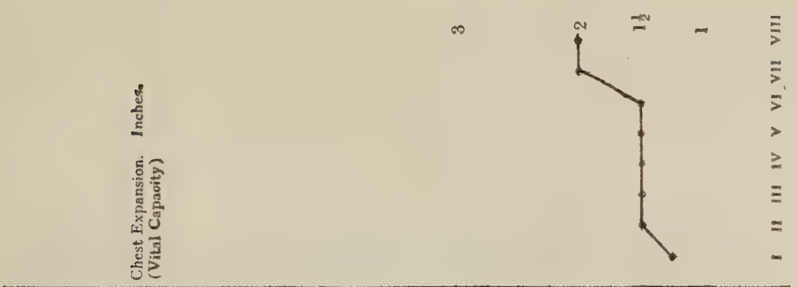
TABLE III

Temporary Norms for a Team of Seven Speech Tests

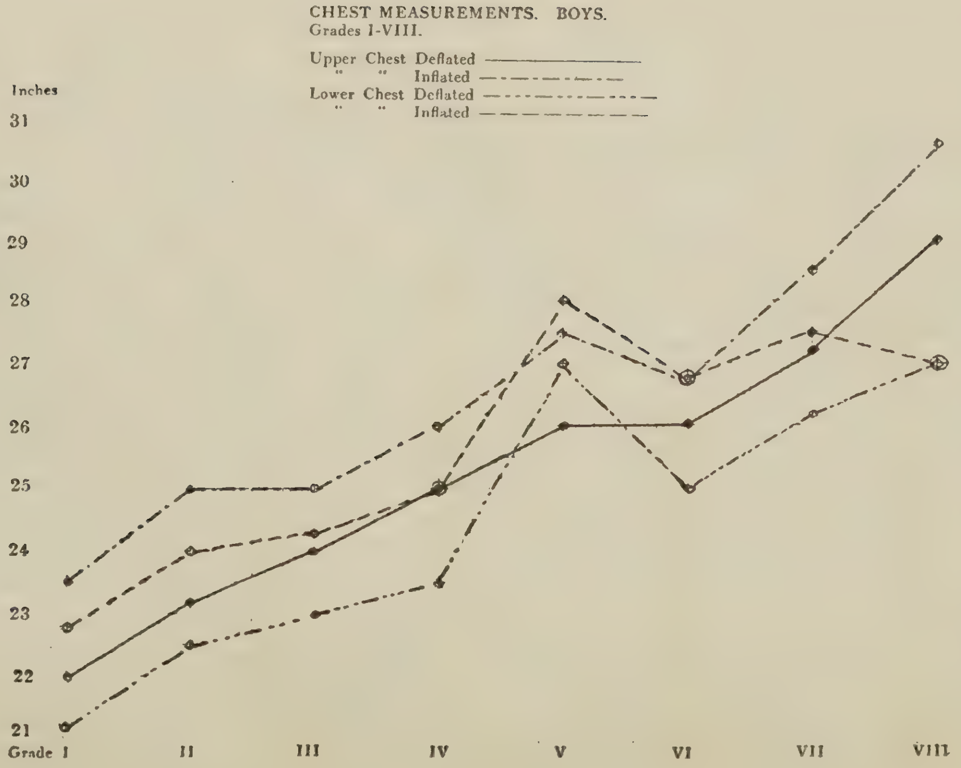
	Test A	Test B	Rate in Spon. Sp.	Rate in Oral R.	Rate in Silent R.	% of Relev. Words	Vocab.	No of Pupils
Grade I	97		120			96%	6 def. in terms of use	36
Grade II	97		120			95%	6 def. in terms of use	38
Grade III	98	97	108	144	138	90%	30 (Terman 10–20 norm)	39
Grade IV	96	97	108	156	146	93%	29 (Starch norm 30)	38
Grade V	96	93	108	204	186	90%	48 (Starch norm 33)	39
Grade VI	96	97	120	174	222	95%	47 (Starch norm 36)	28
Grade VII	96	94	138 to 150	153	207	91%	53 (Starch norm 39)	22
Grade VIII	97	95	129 to 150	150	255	93%	60 (Starch norm 42)	36
Univ. unselected group (40 norms).	97.5	97.5	120 to 150	276	204	96%	73.5 (Terman av. adults norm; 65) (Terman Superior adult norm; 75)	40
Univ. selected speech group	93	94	120 to 150	186	258	93%	72	111

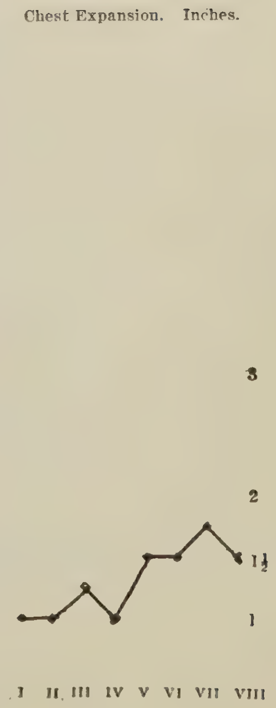


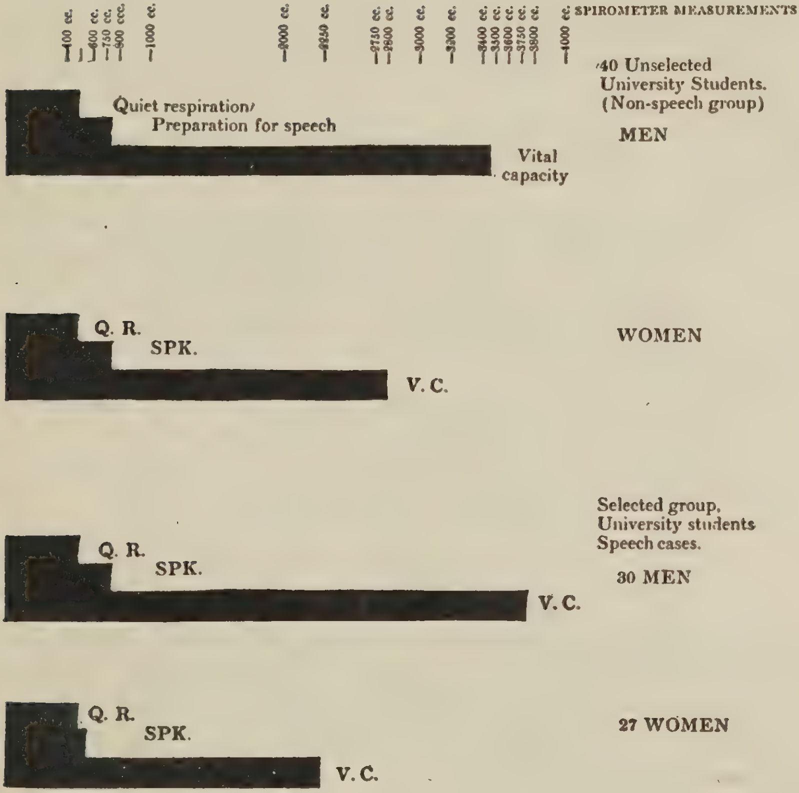
CHEST MEASUREMENTS. BOYS.
Grades I-VIII.



Chest Expansion. Inches.
(Vital Capacity)


CHEST MEASUREMENTS. BOYS.
Grades I-VIII.


Chest Expansion. Inches.


100 cc.
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2250 cc.
2750 cc.
2800 cc.
3000 cc.
3200 cc.
3400 cc.
3500 cc.
3600 cc.
3750 cc.
3800 cc.
4000 cc.
SPIROMETER MEASUREMENTS
40 Unselected University Students. (Non-speech group)
MEN
Quiet respiration
Preparation for speech
Vital capacity
WOMEN
Q. R.
SPK.
V. C.
Selected group. University students Speech cases.
30 MEN
Q. R.
SPK.
V. C.
27 WOMEN
Q. R.
SPK.
V. C.

Table IV

Zero order of coefficients showing the relationship between the criterion, (subjective rating) and tests 1, 2, 3, 4, 5, 6, and 7.

Rating and	and Test I	II	III	IV	V	VI	VII
Test I	.385						
Test II	.251	.749					
Test III	.258	.204	.010				
Test IV	.211	.354	.001	.260			
Test V	.588	.369	.206	.328	.501		
Test VI	.494	.118	.043	.092	.072	.278	
Test VII	.428	.57	.28	.123	.530	.408	.218

The multiple correlation which may be obtained from the working of the regression equation is .731, this being the maximum correlation that one may obtain from the team of tests and subjective speech rating, after they have been weighted to their optimum value.

The final form of the regression equation (Yule's Formula) gives the following table of weights for the various tests:

Test 1.	(Articulation Test A)	.045
Test 2.	(Articulation Test B)	.071
Test 3.	(Spontaneous Speech Rate)	.018
Test 4.	(Oral Reading Rate)	.032
Test 5.	(Silent Reading Rate)	.030
Test 6.	(Percentage of Relevant Words)	.500
Test 7.	(Vocabulary)	.100

In applying the weights to the various speech scores, the weights are simplified by dropping the decimals (multiplying by 100), so that the weights become, respectively, 5, 7, 2, 3, 3, 50 and 10.

A specimen speech rating sheet is given (p. 151), together with method of computing the final score (p. 152).

In studying the percentage of speech cases obtained in various groups, through this study (p. 156) it will be observed that the figures are much higher than those previously given by any investigator in the field of speech. The percentage found in eight grades is 19%. When the University unselected group findings are added, including students from Freshman to Senior classes, the findings are lowered but slightly, becoming 18%. In the University unselected group we should expect to find a type considerably above average in speech performance, who have "survived" in the process of education sufficiently to become members of a select, or specially favored group. It is significant that even here we find many remediable speech defects or slight deviations from good articulation.

The tables given on Pages 43 to 45 give in graphic form the results of chest measurements in the grades (I to VIII), and the results of the spirometer measurements of University men and women.

The name and number of the various tests, together with their location in the series in working the regression equations are:

1. Subjective Speech Rating.	
2. Articulation Test A.	(No. 1 in team of tests).
3. Articulation Test B.	(No. 2 " " " ").
4. Spontaneous Speech Test.	(No. 3 " " " ").
5. Oral Reading Rate.	(No. 4 " " " ").
6. Silent Reading Rate.	(No. 5 " " " ").
7. Percentage of relevant words.	(No. 6 " " " ").
8. Vocabulary.	(No. 7 " " " ").

*Speech Rating Sheet**

Name.............................. Grade........ Age........ Sex........
Language spoken by child first..........................
Language spoken in home..............................

Part I. *Examiner's estimate.*
Grade on scale of 1 to 10; 10 high, 1 low.

1. General Behavioristic Reaction.
   A. Active controlled; active uncontrolled; apathetic-inert; phlegmatic.
   B. Specialized muscle movements such as frowning, sprawling, extraneous muscle movements, or tics.
   C. Postural tensions. General posture; physical anomalies; winging scapulae; protuberant abdomen; depressed torso.
   D. Emotional type. Social-adjustive, over-compensative, repressive, anxiety.

2. General Speech Reaction.
   A. Respiration. Upper or lower costal predominant.
   Measurements.
   Vital capacity.
   Spirometer. Q. R. Spk. Deep.
   B. Voice.
      1. Quality. Resonant; unrest; harsh; hoarse; nasal.
      2. Pitch. Good range; monotonous; extremely high or low.
      3. Volume of tone. Loud; soft; medium; inaudible.
   C. Fundamental speech difficulty.

Examiner's Subjective estimate............

PART II. Objective measurements.

A. Score in Articulation Test A .... x 5 ....
B. Score in Articulation Test B .... x 7 ....
C. Score for Rate in Spontaneous Speech (number of words per minute) .... x 2 ....
D. Score for Oral Reading Rate .... x 3 ....
E. Score for Silent Reading Rate .... x 3 ....
F. Percentage of Relevant Words in Spontaneous Speech .... x 50 ....
G. Vocabulary. (Words in 100 defined)....... .... x 10 ....
Total Score ....
Speech Index ....

(From the total score 6950 must be subtracted [the remainder left over from the regression equation in working out the appropriate weights for each test]. This amount should then be divided by 100 to reduce to the scale used at commencement, before decimals were dropped. This is the speech index. It should compare within a few points, with the subjective estimate given by the examiner at the beginning of the test in Part I.)

Specimen Final Rating Sheet

PART I. Examiner's subjective rating at beginning of test, in a given case is 10.

PART II. Subject's scores made on the objective measurements in Part II are as follows:

Test I.	Score 100	x 5	(weight)	equals	 500
Test II.	Score 100	x 7	(")	"	 700
Test III.	Score 102	x 2	(")	"	 204
Test IV.	Score 156	x 3	(")	"	 468
Test V.	Score 192	x 3	(")	"	 576
Test VI.	Score 96%	x 50	(")	"	 4800
Test VII.	Score 83	x 10	(")	"	 830

Total score 8078
— 6950

100) 1128

Speech index is 11

(Cf. with examiner's estimate of 10 in Part I.)

* C. H. Stoelting & Co., Chicago, Ill., Publishers of Testing Material.

Specimen Rating Sheet

PART I. Examiner's estimate, combined with that of a second instructor, was in this case 18.

PART II. Scores on objective measurements.

Test I. 97 x 5 equals 485
Test II. 100 x 7 " 700
Test III. 102 x 2 " 204
Test IV. 180 x 3 " 540
Test V. 360 x 3 " 1080
Test VI. 100 x 50 " 5000
Test VII. 80 x 10 " 800

Total score 8809
— 6950

100) 1859

Speech index 18

(Of. with speech index 18 given at beginning of Part I.)

Percentage of speech cases in each group

Grade	No. of pupils in grade	No. of Sp. Cases	Percent.
Grade I.	36	11	30%
Grade II.	38	5	13%
Grade III.	39	9	23%
Grade IV.	38	7	18%
Grade V.	39	9	23%
Grade VI.	28	4	14%
Grade VII.	22	3	14%
Grade VIII.	36	5	13%
University 40 normals, unselected group	40	6	15%
University selected group referred for Speech Examination	111	97	87%

Total number examined in all groups........ 427
Total number of speech cases found......... 156
Percentage of speech cases found........... 19% in grades
18% including university non-speech group

In the Madison Schools, exclusive of high schools, there are 4909 pupils in the grades (one to eight) in 13 schools. If in 276 grade pupils examined we find 53 speech cases, we may derive the equation:

53 : 276 :: x : 4909, or 943.

Therefore, we may say that the prediction on the number of cases in need of training, in the entire 13 schools is approximately 943, or approximately 72 pupils in each school.

SUMMARY

I. The importance of silent reading, oral reading and spontaneous speech tests in relation to the speech process is indicated by the high correlation obtained, when they are compared with the criterion, Subjective Speech Rating.

II. Articulation Test A offers a rapid and reasonably accurate method of examination and diagnosis for speech inaccuracies, when a short-cut method of speech testing is desirable, or when the entire set of tests cannot be given.

PART V

CONCLUSIONS

I. A uniform method of speech examination and tabulation of speech difficulties is presented, with tentative results of standardization.

II. The coefficients of correlation between a criterion (the subjective speech rating) and a series of objective speech measurements, in a team of seven objective tests, determine the relative importance of each test in the series.

III. Seven tests have been chosen because of the relationship found to exist between these tests and the rating given by two judges to the individual, in subjective speech rating.

IV. The highest percentage of speech defects formerly given by an investigator for any given group is 13%. In the group of 276 school children examined, 19% were found to be in need of training for mild or more serious speech defects.

V. The inclusion of a series of objective measurements, in forming a judgment as to speech efficacy, increases the accuracy of the individual rating, because it offers a basis for comparison of subjective with objective measurements. Speech measurements have been formerly entirely subjective in type, and the possibility of errors in judgment must therefore be taken into consideration in such subjective judgment.

VI. The multiple correlation .731, or the highest correlation that is obtained from the team of tests and subjective rating, after they have been weighted to their optimum value, indicates an unusually high amount of correlation between the tests chosen and the subjective speech rating, or the criterion.

VII. The apparently slight importance of the articulation tests, until the influence of the other tests have been eliminated is due to the fact that the other tests duplicate in some measure the work performed by these tests. They are important to a correct diagnosis and analysis of the speech difficulty and must therefore be retained in any series of exact measurement of speech inaccuracies. By themselves, the articulations tests correlate sufficiently high to indicate their importance in the speech reaction.

REFERENCES

1. Baldwin, B. T. *Measuring Scale for Physical Growth, A. Fifteenth Yearbook,* Univ. of Chicago Press, Chicago, Ill., 1918.
2. Ballard, P. B. *Sinistrality and Speech, J. of Exper. Pedagog.,* 1912.
3. Betts, Geo. H. *The Distribution and Functions of Mental Imagery. Teachers' Coll., Columbia Univ., Contrib. to Educ.,* No. 26, N. Y., 1909.
4. Blanton, M. G. *Behavior of the Human Infant during the First Thirty Days of Life. Psychol. Rev.,* Vol. 24, No. 6, Nov. 1917.
5. Blanton, Dr. S. *A Survey of Speech Defects. J. of Educ. Psychology,* Vol. 7, 1916, p. 581.
6. Blanton, Dr. S. and M. *Speech Training for Children.* Century Co., N. Y., 1919. Chaps. 2-8.
7. Bluemel. *Stammering and Cognate Defects of Speech.* Vol. 1, pp. 20-24, G. E. Stechert & Co., N. Y., 1913.
8. Cannon, W. B. *Bodily Changes in Pain, Hunger, Fear, and Rage.* D. Appleton & Co., N. Y., 1915.
   Ibid. *J. Philos., Psychol. Sci. Methods,* Vol. XI, pp. 162-165, 1914.
9. Chervin, Dr. *Begaiement et autre Maladies Fontionnelles de la parole.* Institute of Paris, 1901.
10. Cornell, W. C. *Health and Medical Inspection of School Children.* F. A. David & Co., Philadel., 1913, p. 519.
11. Conradi. *Psychology and Pathology of Speech Development in the Child. Ped. Sem.,* 1904, Vo.
12. DeWitt, M. *The Webster Key. Q. J., Sp. Educ.,* Vol. 8, No. 2, April 1922, pp. 156-160.
13. Espeio, L. J. *Mutism. Revista de Psyquiatria.* Lima. Ju. 1918.
14. Fletcher, J. M. *An Experimental Study of Stuttering. Amer. J. of Psychol.* Vol. XXV, pp. 201-255. 1914.
15. Gray, W. S. *Tests in Oral and Silent Reading. School of Educ.* University of Chicago Press, Chicago, Ill.
16. Hollingsworth. *The Psychology of the Functional Neuroses.* D. Appleton & Co., N. Y., 1920, pp. 80-99.
17. Kenyon, Elmer. *The Stammerer and War Service. Volta Rev.,* Vol. XIV, No. 10, Oct. 1917, pp. 56-66.
18. Krapp, G. P. *The Pronunciation of Standard English in America.* Oxford Univ. Press, 1919. American Br.
19. Kussmal. *Siemssen's Cyc. of Med.* Vol. 14, Wm. Wood & Co., N. Y., 1877, Chaps. 1-8.
20. Lemaitre, August. *Le Langage Interieur chez les Enfants.* Viret-Genton, Lausanne, 1902.
21. Nadoleczny, Max. *Disorders of Speech and Phonation in Childhood.* Munich, 1914. (Trans. J. B. Lippincott Co. Philadel., 1914, in Diseases of Children; Shaw & La Fetra.)

22. Osnato, M. *Aphasia and Associated Speech Problems.* P. Hoeber, N. Y., 1920.
23. Prince, M. *The Unconscious.* MacMillan Co., N. Y., 1914.
24. Scripture, E. W. *Researches in Experimental Phonetics. Science,* Vol. 26, pp. 170, August 9, 1907.
25. Starch, D. *Educational Measurements.* (Silent Reading Tests, pp. 21-37).
26. Starch, D. *Experiments in Educ. Psychology.* MacMillan Co., N. Y., 1919, p. 44.
27. Scheppegrell, W. *Etiology and Treatment of Speech Defects. New Orleans Med. & Surg. J.,* 1898, Vol. I, pp. 67-85.
28. Strumpell, Adolp. *Die Entwicklung der Sprache und die aphatischen Sprachstorungen. Z p. Pad. Psychol.,* 1918, pp. 5-21.
29. Stivers, C. J. *Speech Defects. Calif. Med. & Surg. Reporter,* Oct. 1918.
30. Swift, W. *Speech Defects of School Children.* Houghton, Mifflin & Co., Boston, 1919, pp. 18-19.
31. Terman, L. *The Measurements of Intelligence.* (*Vocabulary Tests*). Houghton, Mifflin Co., Chicago, 1916.
32. Thorndike, E. L. *Educational Scales.* (*Understanding of Sentences*). Teacher's College publication, Columbia Univ., N. Y.
33. Trabue & Stockbridge. *Measure Your Mind.* (Language Ability Tests). Doubleday, Page & Co., N. Y., 1921.
34. Tredgold, A. F. *Mental Deficiency.* Wm. Wood & Co., N. Y., 1916, p. 130.
35. Wallin, J. E. *Report of the Board of Education of the City of St. Louis,* 1915-16.
36. Watson, J. *Psychology from the Standpoint of a Behaviorist.* J. B. Lippincott Co., Philadel., 1919, pp. 310-347.
37. Whipple, G. M. *Manual of Mental and Physical Tests.* Warwick & York, Baltimore, 1914. *Simpler Processes,* Vol. I, p. 333.
38. White, W. A. *Outlines of Psychiatry.* Nervous and Mental Diseases Pub. Co., Washington, 1921, pp. 13-23.
39. Wyllie, J. *The Disorders of Speech.* Oliver & Boyd, Edinburg. 1894.
40. Wreschner. *Die Sprache des Kindes,* Zurich. Art. Institut., Orell Fussli, 1912.
41. Wells, F. L. *Linguistic Lapses, with Special Reference to the Perception of Speech Sounds. Archives of Philos. Psychol. & Sci. Methods,* pp. 53-110, No. 6, June 1906.
42. Yule, J. U. *An Introd. to the Theory of Statistics.* London: Chas. Griffin & Co., 1911.
43. Herrick, C. J. *Introduction to Neurology.* W. B. Saunders Co., Philadelphia, 1916, p. 256.
44. Jones, Daniel. *An English Pronouncing Dictionary.* London, J. M. Dent & Sons, 1919.

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